Resources for Research on Analogy:
A Multi-disciplinary Guide

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Abstract: Work on analogy has been done from a number of disciplinary perspectives throughout the history of Western thought. This work is a multidisciplinary guide to theorizing about analogy. It contains 1,406 references, primarily to journal articles and monographs, and primarily to English language material. Classical through to contemporary sources are included. The work is classified into eight different sections (with a number of subsections). A brief introduction to each section is provided. Keywords and key expressions of importance to research on analogy are discussed in the introductory material. Electronic resources for conducting research on analogy are listed as well.


Keywords: Aesthetics, argument scheme, art, axiomatic approach, bijection, case based reasoning (CBR), case law, casuistry, cognition, common law, engineering, ethics, example, exemplar, frame, homology, homomorphism, homoplasy, isomorphism, language, law, literature, logic, logical reconstruction, mathematics, mental model, metaphor, mind, model, model based reasoning, legal particularism, memory, mental space mapping (or conceptual blending), moral particularism, paradigm, pedagogy, precedent, problem solving, prototype, *qiyas, ratio dicindi*, reasoning, religion, retrieval, sciences (natural and social), similarity, simulation theory, simulationism, scheme, *stare decicis*, structure mapping, theology, visual analogy.
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Introduction

Many different things have been referred to as analogies or as analogous, and analogy has been studied from a number of disciplinary perspectives. This work brings together research from different fields to provide a useful reference tool both to those starting out in their research on analogy and to experts who may want a resource guide to inform future work. The research referenced includes, but is not limited to, work from argumentation theory, artificial intelligence (AI), cognitive science, linguistics, mathematics, natural sciences, philosophy, psychology, and (other) social sciences.

This collection of work strives to be inclusive not only in the sense of listing work from different disciplines, but also with respect to different understandings of analogy. While much of the work is contemporary, classical and medieval sources are included as well. This introduces terminological issues that affect the substantive scope of the project. For example, the classical Greek term for analogy (analogia or ἀναλογία) is sometimes translated as “proportion”, which would include ratios (2 is to 4 as 4 is to 8). More recent uses of “analogy” do not always capture some of its more classical uses. It is worth keeping in mind this diversity of uses since some work referenced herein may contain few if any uses of “analogy” but perhaps many references to “proportion” (as in some of Aristotle’s texts).

A mere reference to or use of analogy is insufficient for a work to be included in this collection. The work we have included attempts to theorize about or otherwise elucidate one or more of the uses of analogy. The next section outlines the scope of the work included.

Scope and Limits

This work does not attempt an exhaustive cataloguing of all work done on analogy. Perhaps the most obvious limit is that it primarily catalogues work in English. Where this English language work cites foreign language work, that foreign language work on analogy has been included. Similarly, the bulk of the work referenced herein is from Western academic traditions; where non-Western work has been cited by Western work, it has been included. With respect to the form of publication, we are primarily concerned to catalogue journal articles and monographs. Some high caliber encyclopedia entries (for example, entries from MIT CogNet or the Stanford Encyclopedia of Philosophy) are also included. Textbooks and papers in conference proceedings are not generally included, though there are exceptions. The number of introductory textbooks in ethics, law, logic, reasoning skills, and the like are legion, and many of them mention analogy. The guiding concern throughout this work has been to make this collection of resources as useful as possible to researchers looking for advanced theorizing about
analogy. If a textbook is cited and engaged in journal articles or monographs (i.e. the theoretical literature) on analogy, then it is included. With respect to papers in conference proceedings, they are included either if they are cited in the theoretical literature or if they are part of a major theorist’s body of work on analogy. Paper versions of conference proceedings for conferences devoted entirely to analogy are also included. A list of research tools is included below (Further Resources) for those who may wish to pursue a more exhaustive study of work devoted or related to analogy. Some of these resources can be especially useful in locating material in conference proceedings.

Division of Work

There are different ways to divide up a collection of references. Each will have its own advantages and disadvantages. The principal decision we faced was whether to divide references by the subject matter of the analogy or the disciplinary or methodological approach taken to the subject. Our guiding concern throughout was to make this work as useful as possible to researchers, and this led us to group references by subject matter. If we had grouped work by disciplinary approach, then the section on philosophical approaches would include philosophical reflections on analogy in ethics, law, natural science, mathematics, religion, social science, and other areas as well. Something similar would happen if we grouped all work in AI in one section. There is an advantage to this approach: those interested, say, only in work in AI on analogy would could go to one section and get exactly what is desired. There are also disadvantages. First, much work on analogy tends to be domain specific. It is work on analogy in Law, or analogy in one or more of the Natural Sciences, or in Mathematics, and so on. Dividing work by discipline or methodological approach would make it much more difficult to find the work on analogy focused on a specific subject matter. Second, even when work on analogy is clearly making use of methods from a specific discipline, it is not unusual for that work to cite research from other disciplines. For example, there is no shortage of work in AI or Law that cites work in Philosophy. Given that much work is subject or domain specific, and given that researchers are often interested in making use of work outside their own discipline when theorizing about analogy in a particular domain, dividing work up by the subject matter of the analogy is looking increasingly well motivated. Third, there are times when it is very difficult to be clear on what exactly the disciplinary approach is. There is overlap between Cognitive Science and AI, and Cognitive Science and Linguistics, and Cognitive Science and Psychology. Dividing work up by the subject matter of the analogy largely side-steps these issues. For example, if the subject matter of the analogy is mind or mental states, then the work is placed in the Mind, Consciousness, or Cognition section (regardless of whether the work is
done by an AI researcher, a cognitive scientist, a philosopher, or a psychologist). Of course, focusing on the subject matter of the analogy has its own problems. It turns out that much work on analogy is general or wide ranging in nature. In other words, it is not aimed at a specific subject or domain (Law, Mathematics, or whatever), or it is specifically aimed at two or more domains. For this reason, there is a section entitled General or Wide Ranging, and it contains several subsections. While this may seem a bit of an awkward accommodation, we prefer it over a disciplinary or methodological division of work. The reason is that even within the individual subsections of the General or Wide Ranging category, work from different disciplines using different methods can be found. The preceding notwithstanding, there are still difficulties with an approach focused on subject matter. Sometimes, it is not always clear what counts as a subject matter. Is visual reasoning a distinct subject matter? Should work on visual analogy be seen as a distinct subject matter and collected under one heading? It is a tough call. Some work on visual analogy fits neatly in the Science or Engineering section since it deals with a scientific subject, so we placed it in that section; some work on visual analogy is more general, and this is why we collected such work in one of the subsections of the General or Wide Ranging category. That said, we could see how there could be differences of opinion, and we recognize that there would be some utility in collecting all work on visual analogy in one section (even if some of it is devoted specifically to natural science). Each of the sections and subsections below contains a brief summary of the contents of that section. In cases where there is not general agreement on what constitutes a domain or subject matter, we have endeavored to make it clear how work has been classified.

**Other Key Expressions**

Given the number of approaches to the study of analogy and the variety of phenomena referred to as analogies or analogous, it is not surprising that there is a variety of key terms and expressions associated with the study of analogy. Some of these terms are summarized here, and they will be indicated in bold print in what follows for easy identification.

Argument scheme, axiomatic approach, bijection, case based reasoning (CBR), case law, casuistry, common law, example, exemplar, frame, homology, homomorphism, homoplasty, isomorphism, mental model, metaphor, model, model based reasoning, legal particularism, mental space mapping (or conceptual blending), moral particularism, paradigm, precedent, prototype, *qiyas*, *ratio dicindi*, similarity, simulation theory, simulationism, scheme, *stare decicis*, structure mapping, visual analogy.
Sections and Subsections

The first three sections below list work where the subject of analogy includes topics of concern often falling under the heading *humanities*. This is not to say that the work is done only by those in the humanities. Far from it. Much work on analogy in law has been done by researchers in AI. Sections four and five deal with analogy in the sciences (including engineering) and mathematics. Again, contributions to analogy in these domains need not come from its practitioners. Philosophers of science and mathematics have contributed to understanding analogy in these areas. For reasons explained in section six, analogies taking as their subject mind or cognition are collected under one heading. Work on analogy that is of a more general or wide ranging nature is collected in section seven, and work that does not fit into any of the preceding categories is collected in section eight.

1. Arts or Aesthetics
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1. Arts or Aesthetics

Work in this section takes as its subject matter art or aesthetic considerations. While there is not a lot of work listed here, researchers are encouraged to examine work in the General or Wide Ranging sections that may be of relevance. For example, section 7.3 on visual analogy contains material on analogy that could be of interest to practitioners of the fine arts. Section 7.2 contains material on the
relationship between metaphor and analogy that may be of interest to those studying literature. There is also work there that compares and contrasts the language(s) of art with language from other domains. Section 7.7 contains the most diverse collection of materials, some of which might prove interesting for those studying analogy in the arts.

2. Normative Treatments of Action

Some analogies take action as their subject matter. Work concerned with predicting or describing action using analogies is not listed in this section. The work listed here takes as its subject matter the normative treatment of action or related notions. Sometimes the analogy is about an action directly: action \( x \) is immoral because it is analogous to action \( y \), which is clearly immoral. Sometimes, the analogy is about a concept related to action. For example, it is possible to argue by analogy that \( x \) constitutes a trade secret because \( y \) is generally agreed to constitute a trade secret. While this is an argument about the legal concept of trade secret, it is clearly connected to action since trade secrets are protected by law, and actions can be classified as illegal if considered a violation of trade secret law. While this section is about the normative treatment of action, this does not mean that the subject matter of the analogy must be action in every instance. Sometimes, concepts or rules (used in normative reasoning about action) will be the primary subject matter of the analogy.

2.1 Law

One of the most familiar forms of reasoning by analogy can be found in law. There is a disputed case (the target), and someone reasons from analogous case (the source) to support some conclusion about the target. The target case is often distinguished from other possible sources. There has been much disagreement about how to understand analogical legal reasoning. While the work included in this section comes from a variety of disciplinary perspectives, it concerns mostly analogies in law in the English language legal traditions. Since this reference work is devoted primarily to work in English, this is not surprising. That said, there is work in English on analogy and case based reasoning in Islamic and Jewish law, and it has been included. Those interested in analogy in Islamic (specifically Suni) legal thought should research the term *qiyas* (an Arabic expression translated as analogy or analogical reasoning).

Case based reasoning (CBR) is a subfield of AI research that has intimate connections with analogy. Some of this work is in law; some of it pertains to other domains. That said, the work in Law and AI draws heavily on case based reasoners. Some of the work in this field,
especially as it pertains to analogy, has been included. See the section on OTHER RESOURCES for how to find more work.

**Precedent** is a very important concept in law, so is the idea of following precedent or staying decided – *stare decisis*. Linked to these notions is the rationale on which a case is decided – the *ratio decidendi*. In setting a precedent, a court will generally announce its *ratio decidendi* which constrains future courts (though not absolutely) through the doctrine of *stare decisis*. Work by philosophers, jurists, argumentation theorists, and AI researchers have engaged all these notions in conjunction with analogical, and more generally, case based reasoning. **Legal particularism** is a view on the status of cases in legal reasoning, and it too is relevant to the views that have been held on analogy. While this reference work is not devoted to the key terms identified in bold, some work pertaining to those concepts (as they pertain to analogy) has been included. Researchers interested in more literature pertaining to the concepts identified in bold are (again) encouraged to consult the tools listed under Other Resources, especially those focusing on legal resources.

**Argument scheme** is an expression used largely by argumentation theorists and logicians. Work regarding the scheme(s) that appropriately describe analogical arguments and how it (they) relate to other schemes has been included. However, not all work on schemes has been included, just the work engaging analogy.

Some of the work in this section includes theorizing about analogies outside the law. For example Brewer (1996) offers a general theory of analogy (not just of analogy in the law). *However*, the vast majority of that paper deals with analogy in the law; all references to that paper that we have found are by philosophers of law or jurisprudential theorists, and the paper was published in the Harvard Law Review. So while a case could be made that some of the work in this section could have been placed in one of the General of Wide Ranging subsections, if we judged the work to be primarily and mostly of concern to those theorizing about analogy in the law, we placed it in this section.

### 2.2 Ethics or Action

Theorizing about the way analogy is used in ethical discourse is included in this section. So is theorizing about analogy that pertains to evaluating action more generally. Discussions of analogies in political or policy discourses are included here. Discussions of analogy that engage more than one area of evaluative discourse pertaining to action are included here as well. For example, work that examines analogy in ethics and law, or politics and law, or ethics and prudence fall in this section. Given that some work takes up discussion of analogy in more than one domain of action discourse, and given that there are disputes about how to delineate some of the domains of action discourse, it is useful to group these discourses on analogy together.
Casuistry is an approach (or family of approaches) to moral reasoning (and reasoning about action more generally) stressing the importance of cases. Moral particularism refers to a family of moral philosophies stressing the importance of cases and downplaying (and sometimes rejecting entirely) the importance of rules. When theorists working in either of the aforementioned traditions engage analogy, their work is included. Those doing research on analogy as used in ethics, or action discourse more generally, may be interested in examining these approaches since some (though certainly not all) views on analogy are grounded in the theoretical presuppositions of these approaches. The notion of argument scheme may be useful to those doing research on analogy in action discourses beyond the law.

3. Religion or Theology: Language, Logic, or Metaphysics

While the work referenced in this section at least touches on religious or theological thought, it would be a mistake to think that the authors referenced here were only or even primarily interested in religious language. Some medieval thinkers were interested in providing theories of language, and analogy was part of the theory, and religious uses of language were engaged, but there was more to both the theory of analogy and the theory of language than its application to religious language. Some of this work is sufficiently general and wide ranging – engaging a variety of issues pertaining to the nature of language, logic, or metaphysics – that a case could be made that it should be included in one of the General or Wide Ranging sections below. That said, those doing research on analogy in religion may find it useful to have references engaging analogy in religious discourse collected in one section. Given citation patterns, this also makes sense: while Aquinas and Cajetan have views on analogy that go beyond its uses in religious discourse, more recent authors who cite their work on analogy are often writing about their views on religious language. Those interested in general discussions of analogy that do not engage religious discourse are encouraged to examine Section 7.

Metaphor and model come up in recent discussions of analogy in religious discourse. When these discussions explicitly engage the issue of analogy, they are included. However, not all work on metaphors and models is included. Researchers interested in analogy in religious language will likely find related discussions on metaphors and models to be useful.
4. Sciences or Engineering

Analogies that take as their subject material from the natural and social, applied and theoretical sciences are included in this section. The exceptions are psychology and cognitive science (for reasons explained at the end of this section and in Section 6).

In discussions of analogy in science, there are two other terms that frequently appear: metaphors and models. Model based reasoning is another expression with increasing currency in discussions of scientific reasoning and engineering. There is no general agreement on the scope of any of these expressions. Black (1977, p. 30) has claimed that every metaphor is mediated by an analogy, and that “Every metaphor is the tip of submerged model.” Not everyone holds such views. Bailer-Jones (2002, p.123) provides the example of gravitational lens as a case where metaphorical language is being used without there being any deep structure correspondences generally thought to be characteristic of analogies and models. As she points out, all that a gravitational lens and an optical lens have in common is the bending of light; the means by which light is bent are completely different, so it is far from obvious that there are any deep structural correspondences at work. Bailer-Jones (2002) provides a very useful survey discussion of different views on the relationship between analogies, metaphors, and models.

While this work does not purport to be a reference work on metaphors or models, there are reasons to include some work on these subjects. First, many have taken analogies to be in some way related to metaphor or models. Work that engages the nature of that relationship (regardless of the substantive position defended) is included. Also, some researchers doing work on analogy may be interested (and may see analogies) in what others refer to as metaphors and models.

Exemplar, paradigm, and prototype are also thought by some to be related to analogy. Work in the philosophy of science and engineering sometimes engages these concepts as they relate to analogy. “Exemplar” and “paradigm” tend to be common in discussions of science. Discussions of engineering tend to focus on the notion of “prototype.” This latter notion is also used in a very different way in linguistics, psychology and cognitive science in presenting a theory of concepts. For example, *bird* is a concept that may be said to have more or less prototypical instances (robin or sparrow on the one hand as compared to ostrich or penguin on the other). When engineers talk about the importance of prototypes, they are not making a point about the theory of concepts but about how they reason from a past model or production to a current project.

In biology, similarity relations are delineated in different ways. Analogy, homology, and homoplasy are all similarity relations in this field. If two anatomical features perform the same or similar functions, they are said to be analogous. Two structures are said to be homologous
if they share a common ancestry. If two structures have common function and common ancestry, then they are both analogous and homologous. Homoplasy exists if two structures are analogous but have different ancestries. Homology is also an important notion in genetics.

Quite a bit of work has been done on the use of analogies that take as their subject matter the mind or mental states. Philosophers have made many contributions in this area, and these contributions are often seen as part of the philosophy of mind. They are of interest to psychologists, cognitive scientists and others as well. The reverse is also true: psychologists and cognitive scientists have studied analogies that take mind or mental states as the subject matter, and this work is of interest to philosophers and others. A separate section has been created for analogies that take mind as their subject matter: Mind, Consciousness, or Cognition (Section 6 below). Also, much work in psychology and cognitive science studies analogy as it is related to developmental issues, memory, language processing and the like. The subject matters of the analogies in these inquiries varies dramatically, so much of that work is found in the various subsections of the General and Wide Ranging category (Section 7 below).

5. Mathematics

Research on the use of analogy in mathematics, whether for pedagogical or other reasons, is included in this section. For work that studies analogy in mathematics and other areas of reasoning, see the General or Wide Ranging sections.

The notions of isomorphism and homomorphism are important in defining structure preserving mappings. An analogy in mathematics is sometimes thought of in terms of a bijection that preserves some sort of structure. A morphism is the abstraction derived from a structure preserving map. A different approach to analogy in mathematics stresses an axiomatic approach, where laws or axioms are central to describing the analogy. Dirk Schlimm (2008) has done some outstanding and concise work in outlining different approaches to analogy in mathematics.

6. Mind, Consciousness, or Cognition

The works listed in this section are those where the analogies studied take as their subject matter one or more of mind, mentality, conscious or unconscious mental states, intentional states, cognition, or cognate matters. Studying analogy using a psychological or cognitive science approach is neither necessary nor sufficient for inclusion in this section.
It is not necessary for the reason mentioned above: the study of analogies pertaining to the mind is not restricted to psychology or cognitive science. It is not sufficient because psychological and cognitive science approaches can be applied to analogies whose subject matter is not the mind. There is psychological and cognitive science work on analogy in the Mathematics section, and it is in that section because the subject matter of the analogy is mathematics. Indeed, work using psychological or cognitive science methodologies can be found throughout this reference work. From the fact that a psychological or cognitive science methodology is being used, it does not follow that the subject matter of the analogy is the mind or mental states. To be sure, minds are involved in doing analogical reasoning in mathematics, but then again, minds can be involved in doing analogical reasoning in any of the subject domains discussed herein, so minds being involved is simply not enough to classify work as belonging to this section. The type of analogy being discussed has to be explicitly about mind, mental states, or cognition to be in this section.

Philosophers, Psychologists, and Cognitive Scientists have engaged in debate over how we come to know about the existence of other minds or of mental states. In the early days, thinkers discussed the argument from analogy: other people behave the way I do in certain contexts; I know that I have mental states that give rise to those types of behaviour in those contexts, so other folks (by analogy) likely have (similar or the same type of) mental states I have that give rise to those types of behaviours in those contexts. This sort of argument from analogy is still discussed, and some of the discussion draws heavily on work in cognitive science and psychology. One strain of discussion has evolved largely into a debate between Theory-Theory and Simulation Theory (or Simulationism). Those subscribing to the former position emphasize the importance of an internally represented theory in attributing mental states to others; defenders of the latter approach stress the importance of an internal simulation of the target agent in order to attribute mental states to the target. Simulationism is most closely linked to the analogy approach to understanding other minds. While this reference work does not purport to extensively catalogue work on Simulationism, some work that discusses analogy has been included. Those interested in more should search either “Simulation Theory” (sometimes hyphenated) or “Simulationism.”

7. General or Wide Ranging

Much work on analogy is not devoted to a particular subject matter. It is of a general nature. Some is wide ranging in the sense that it is explicitly devoted to more than one of the above categories. It may, for example, deal with analogy in law and one or more of the sciences, or analogy in mathematics and the sciences. Work in ethics and law is collected in the
Ethics or Action section. Work devoted to other combinations of the above categories or that is very general in nature is collected in this section. There is quite a bit of work of a general or wide ranging nature, so some subdivisions are appropriate. Before getting to that, it would be useful to mention some words and expressions that would be useful for research on analogy.

**Similarity** is a term of significance in artificial intelligence, cognitive science, and psychology, and it has deep connections with analogy, though researchers generally agree that analogy and similarity are not the same thing. We will insist herein neither on (i) the exact senses of the different uses of similarity nor (ii) on a particular view of the relationship between similarity and analogy. While this work is not a bibliography devoted to similarity, some work on that subject as it is related to analogy has been included. Edwinna Rissland (2006) provides (a) an excellent introduction to and survey of the importance of similarity in AI, and (b) discusses similarity with respect to case based reasoning, analogy, *exemplars, prototypes*, and much more. Steven Sloman and Lance Rips (1998) edited a very useful collection of papers engaging the issue of similarity in psychology and cognitive science in a number of different ways. Researchers interested in analogy may also be interested in some of the work that has been done on similarity.

The notion of **scheme** also plays an important role in AI, psychology, and cognitive science. **Argument scheme** plays a role in argumentation theory and philosophy (especially logic). **Mental models** are discussed in psychology and cognitive science, and some of this work is also relevant to analogy.

**Mental space mapping** theory (also referred to as **conceptual blending**) is a more recent development in the literature in psychology and cognitive science. Fauconnier and Turner (2002) provide a useful overview of this approach, in which analogy plays a key role. Mental space mapping is different from the *structure mapping* approach found in the work of Gentner and many others.

All the key terms mentioned in this section have played a role in the general or wide ranging study of analogy. They have also played roles in more domain restricted work, but given the purported range of applicability of these notions, they were discussed in this section.

### 7.1 Child Development, Learning, Pedagogy, and Problem Solving

Some work that is general or wide ranging with respect to the topic of analogy is focused specifically on developmental issues in children, pedagogy, problem solving, or combinations of these – hence the subsection devoted to this collection of issues. Only developmental or pedagogical work of a general or wide ranging nature will be found in this section. Work that is devoted to the pedagogical uses of analogy in a specific domain covered in one of the above sections (for example, Mathematics) can be found in that section.
7.2 Language or Metaphysics
General theorizing about the nature of language with applications to analogy; general theorizing about the nature of analogy for the purpose of improving our understanding of language or language processing, and either of the preceding as they relate to general issues in metaphysics – all of these are included in this section. For example, what is metaphor? How is it related to analogy? Work attempting to answer such questions in a general or wide ranging manner is collected in this section. (Work devoted to metaphor and analogy in the sciences is found in the Sciences or Engineering section. Other focused work can be found in its respective section.) General discussions of metaphysical (but not religious) analogies are included in this section.

7.3 Visual Analogy
Not all researchers believe that analogies have to be expressed in a linguistic manner. Visual analogies have to do with analogies between pictures, images, or anything having visual content not in a sentential form. Some work on visual analogies is included in other sections. For example, with respect to visual analogies having a mathematical subject matter, work theorizing about such analogies is included in the Mathematics section. However, some work on visual analogy is sufficiently general that it has been collected and placed in this section.

7.4 Animal
Work has been done on whether and to what extent animals can engage in analogical reasoning or problem solving. It has been collected in this section. The issue is not whether animals are the subject matter of the analogy. The subject matter of the analogy can vary. Work dedicated to whether animals have a theory of mind or whether they reason analogically about the mental states of other beings is included in the Mind, Consciousness, or Cognition section.

7.5 Memory or Retrieval
There is some work on analogy where the subject matter of the analogy itself is general or wide ranging, but the focus of the work is on retrieving an analogue from memory. In some cases, the memory at issue is human memory; in other cases, the memory is computer memory (where there may or not be claims about the relationship to human memory). Such work is collected in this section. Work on retrieval of analogies specific to a subject – such as law – can be found in the appropriate section above.

7.6 Logic
Work included in this section takes as the subject matter of analogy logic or some part of logic (for example, logical form or logical operators). Since logical forms are general in nature and can be instantiated in a number of different domains, work on logic has been included as a
subsection of the General or Wide Ranging section. Not all work pertaining to logic is included in this subsection. Far from it. Logical reconstructions of analogy can be found throughout this reference work. For example, reconstructions of the logic of analogy in legal discourse can be found in the subsection devoted to law. General discussions of the logical structure of analogy, analogical argument, or analogical reasoning (where the subject matter of the analogy varies) can be found in the next subsection (Various). When the subject matter of the analogy itself is logic or a logical structure or operator, then theorizing about such analogies is included in the Logic subsection.

7.7 Various
Work that is sufficiently general or wide ranging but does not fit in the above subsections has been included in this subsection.

8. Other
Some work on analogy is very focused, so it would be inappropriate to classify it under General or Wide Ranging, yet none of the above categories is appropriate for this focused work. It has been collected here.

Further Resources
There is a variety of resources that allow for online searches for work on analogy. Some of these resources allow for access to resources not listed in this work. For example, with the exceptions listed above, not all conference proceedings papers have been included here. Some of the resources below allow for a searching of these and other resources.

The Association for Computing Machinery (ACM, http://www.acm.org/) maintains a Digital Library (http://portal.acm.org/dl.cfm). Search for any ACM publication and retrieve the full text of journal and magazine articles, conference proceedings papers and more. For those interested in conference proceedings for the International Conference for Artificial Intelligence and Law (ICAIL), go to the ACM Digital Library home page (second link in this paragraph); click on “Proceedings”, and then scroll and click “ICAIL” to see a list of conference proceedings for that group. Lots of work here on case based reasoning, some of which pertains to analogy. Website requires payment for proceedings and videos.

The American Psychological Association (APA, http://www.apa.org/publications/) allows for online searches of all its publications, including conference proceedings. Both PsycINFO and
PsycARTICLES are available through the APA databases. Databases run through PsycNET, which requires subscription.

Cambridge University Press (http://www.cambridge.org/) is a major humanities and science publisher. Online searches of its books and journals are available. Books need to be paid for singly; journals mostly require subscription, though some have free content (marked by a red “F”), or trial access (marked by a green “T”).


The Collection of Computer Science Bibliographies (http://liinwww.ira.uka.de/bibliography/) provides online search for journals, magazines and books (including conference proceedings). This is a free online resource.

Elsevier (http://www.elsevier.com/) is a major science and humanities publisher and offers online searches and text access. Aside from some free sample issues of journals, content requires a subscription.

Hein Online (http://heinonline.org/) provides searches and text access to law reviews and periodicals. Access to content requires a subscription.

The Institute of Electrical and Electronics Engineers (IEEE, http://www.ieee.org/portal/site) allows for searches and text access of their digital library. Free trials available, but content otherwise requires a subscriptions.

The ISI Web of Knowledge (http://apps.isiknowledge.com/) provides searches and text access to a very wide range of Humanities and Science sources. Content requires a subscription.

JSTOR (http://www.jstor.org/) provides access to journals in a wide-range of fields including those in the humanities and sciences. Content requires a subscription.

LegalTrac (http://find.galegroup.com/) provides searches and text access to law reviews and periodicals. Access requires a subscription.

LexisNexis (http://academic.lexisnexis.com/online-services/academic-overview.aspx) provides searches and text access to law reviews and periodicals. Subscription required.
LLMC Digital (http://www.llmcdigital.org/) provides searches and text access to law reviews and periodicals. Subscription required.


Oxford University Press (http://www.oup.co.uk/) is a major humanities and science publisher. Free online searches of their books and journals are available. Journals require subscription. Books can be purchased separately.

The Philosopher’s Index (http://www.philinfo.org/) provides search for periodicals and books in all areas of philosophy. Major conference proceedings published as bound anthologies are also included. Subscription required.

ScienceDirect offers journals from the physical sciences and engineering, life sciences, health sciences, social sciences and humanities. Content requires a subscription.

Springer (http://www.springer.com/) is a major science and humanities publisher and offers online searches and text access, including access to Lecture Notes in Computer Science. Many conference proceedings can be found here. Abstracts can be read for free, but other content requires a subscription.

Wiley InterScience (http://www3.interscience.wiley.com/) allows for searches and text access of Blackwell and Wiley sources. Humanities and science resources are available. Content requires a subscription.

Wilson Web (http://vnweb.hwwilsonweb.com/hww/login.jhtml) provides searches and text access to a very wide range of humanities and science sources. Content requires a subscription.
REFERENCES

1. ARTS OR AESTHETICS


2. NORMATIVE TREATMENTS OF ACTION

2.1 LAW


Resources for Research on Analogy 107

Intelligence and Law and Pragma-Dialectics. *Argumentation: An International Journal on Reasoning* 19, no. 4: 393-400.


112 Marcello Guarini et al.


114 Marcello Guarini et al.


2.2 ETHICS OR ACTION


3. RELIGION OR THEOLOGY: LANGUAGE, LOGIC, OR METAPHYSICS


### 4. SCIENCES OR ENGINEERING

42. Clement, John, and David Brown. 1984. *Using analogical reasoning to deal with "deep" misconceptions in physics*. Fund for the Improvement of Postsecondary Education.


158. Lefebvre, René. 1998. Aristote Zoologue: Décrire, Comparer, 
   Définir, Classer. Archives de Philosophie 61, no. 1 (January-
   March): 33-59.
160. Little, J. 2008. The Role of Analogy in George Gamow's 
   Derivation of Drop Energy. Technical Communication Quarterly 
   17: 1-19.
161. Little, J. 2000. Analogy in Science: Where Do We Go From 
   Classification of Domain Models in Support of Analogical Reuse. 
164. Machamer, Peter. 2000. The nature of metaphor and scientific 
   description. In Metaphor and analogy in the sciences. Edited by 
   not? In Causal inference. Edited by K. J. Rothman. Chesnut Hill, 
   MA: Epidemiology Resources.
166. Magnani, Lorenzo, and Ping Li ed. 2007. Model-based reasoning 
   in science, technology and medicine. Berlin; Heidelberg: 
   Springer-Verlag.
   based reasoning: Science, technology, values. New York: Kluwer 
   Academic/ Plenum Publishers.
   2002. Logical and computational aspects of model-based 
   1999. Model-based reasoning in scientific discovery. New York: 
   Plenum.
170. Maher, Patrick. 2004. Probability captures the logic of scientific 
   confirmation. In Contemporary debates in philosophy of science. 
   Models of Hesse and Carnap and Kemeny. Erkenntnis: An 
   International Journal of Analytic Philosophy 5, pt. 5, no. 2: 183-
   216.
   Journal for Artificial Intelligence 9, no. 2, pp. 241-255: May 
   Conceptual 1999.


265. Whewell, William. 1847. The philosophy of the inductive sciences, founded upon their history. London: John W. Parker.


5. MATHEMATICS


### 6. MIND, CONSCIOUSNESS, OR COGNITION


7. GENERAL OR WIDE RANGING

7.1 CHILD DEVELOPMENT, LEARNING, PEDAGOGY, OR PROBLEM SOLVING


### 7.2 Language or Metaphysics

38. Gentner, Dedre, Arthur B. Markman. 1995. Similarity is like analogy: Structural alignment in comparison. In *Similarity in...*


### 7.3 Visual Analogy


7.4 Animal


7.5 Memory or Retrieval
26. Zareva-Toncheva, Neda, Boicho N. Kokinov. 2003. Blending of non-similar episodes as a result of analogical mapping with a

7.6 LOGIC


7.7 VARIOUS


Rips. Amsterdam, the Netherlands: Elsevier Science Publishers, B.V.


144. Kokinov, Boicho N. 1998. Analogy is like cognition: Dynamic, emergent, and context-sensitive. In *Advances in analogy research: Integration of theory and data from the cognitive,


**OTHER**


